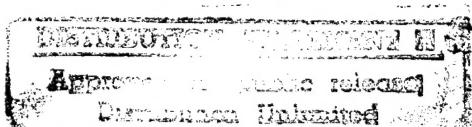


**Modelling Methane-Rich Sediments of
Eckernförde Bay**

A Workshop held in
Eckernförde, Germany

26 - 30 June 1995

Stadthotel, 24 340 Eckernförde, Germany



19960701 060

DTIC QUALITY INSPECTED 1

Geotechnical Properties of Six Closely Spaced Sites from Eckernfoerde Bay, Germany

DRAFT

K. McCrocklin, M. Meyer, and R. Bennett

This study was conducted to observe the variability of geotechnical properties of shallow marine sediments collected in close proximity to one another. The sediment found in Eckernfoerde Bay was primarily soft, silty, organic clay. The site for collection was centered around a buoy located at 54°29.88N and 9°59.68E. From this reference point, six sites were chosen to form a circle and from each site 3, 3 meter cores were collected. At the northern most site, pressure cores were taken for cat-scanning and analysis in a hyperbaric chamber. We hope to be able to show the variability in marine sediments with in a confined region through our collection of multiple cores from this relatively small test site.

The cores were collected on board two ships the Planet and the Kronyar. Upon collection of the sediment the cores were cut into 1.5 m lengths, capped, wrapped, and stored for transport to the shore based lab.

The geotechnical testing on these cores was performed at both the University of Kiel and some samples were also transported to the Naval Research Laboratory, Stennis Space Center for further analyses.

At the University of Kiel the laboratory analysis consisted of vane shear, water content, and volumetric tube analyses. The sediment transported to the Naval Research Laboratory was subsampled for the following analyses: (1) Density analysis, (2) Atterberg analysis, (3) Organic Carbon analysis, and (4) Grain Size analysis. The information presented in this abstract is only representative of the completed analyses. At this time, analyses have primarily concentrated on site 1, while a significant amount of work has yet to be completed on the remaining five sites.

Beginning with the testing performed in Germany, water contents from the cores range from a high of 282% (corrected for a salinity of 25 ppt) to a low of 188% (figure 1).

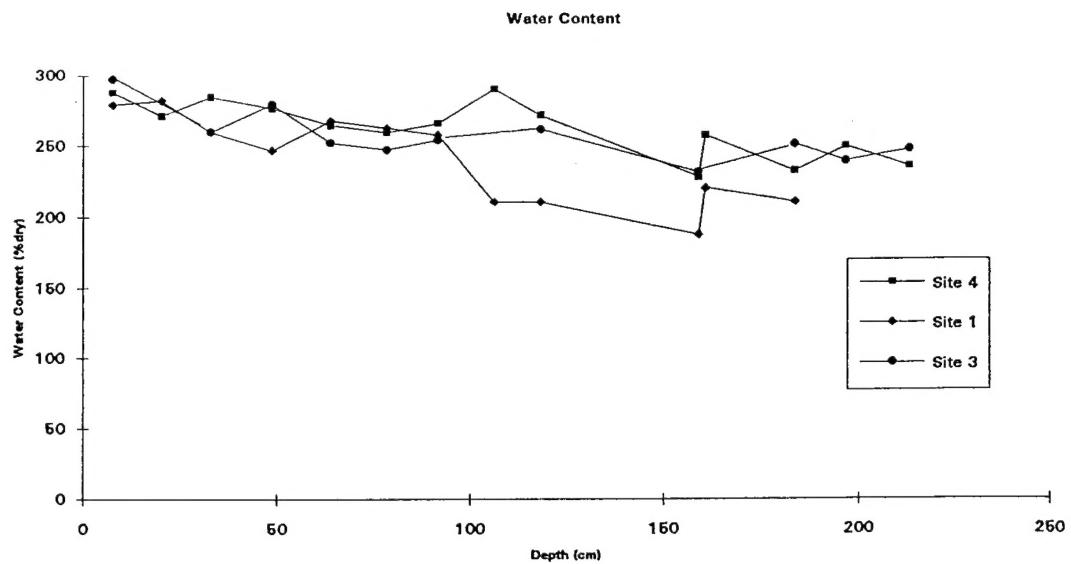


Figure 1 Water Content (%dry) Gravity Core 1 Site 1

Volumetric tubes were also used on both the pressure cores and the gravity cores to provide data for the determination of the % gas in the sediment (figure 2). The quantity of gas was also determined by catscanning, which was later analyzed in the United States.

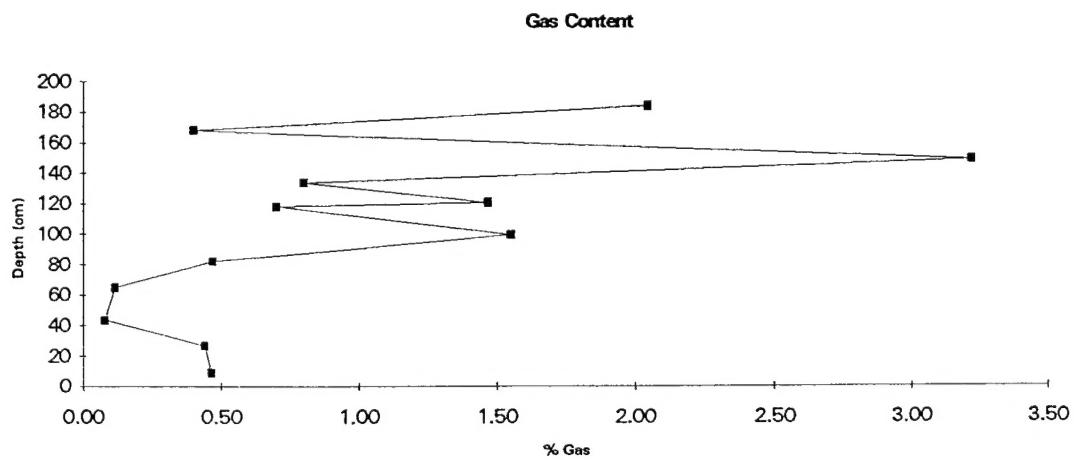


Figure 2 % Gas in Gravity Core 1 Site 1

With sub-sampling complete, samples were transported to the United States for further analysis. Dried samples from the volumetric tube analyses were ground and dried at 105°C for an additional 12 hours. These samples were used for average grain density determination; examples of the preliminary results can be seen in Table 1.

The average grain density (g/cc) for all cores taken is being determined by using a pentapycnometer. In figure 3, the average value was 2.40 g/cc with a sinusoidal trend ranging from a high of 2.42 g/cc to a low of 2.38 g/cc. Atterberg analysis was conducted on samples taken from the interface (0-8cm), middle (140-150cm), and the bottom (290-300cm). The limit analyses for the interface sample resulted in a liquid limit of 71%, a plastic limit of 61%, and a plasticity index of 10%. The sand, silt, and clay fraction for the interface sample is as follows: sand % 0.67, silt % 51.16, and clay % 48.17. The limit analysis for the middle sample resulted in a liquid limit of 95%, a plastic limit of 65%, and a plasticity index of 30%. The sand, silt, and clay fraction analysis yielded a sand % of 1.06, and silt % of 42.67, and a clay % of 56.27. The bottom section has a liquid limit of 68%, a plastic limit of 66%, and a plasticity index of 2%. The sand, silt, and clay analysis yield a sand % of 0.69, a silt % of 45.14, and a clay % of 54.17. The organic carbon analysis of gravity core 1 was divided in the same manor as the Atterberg analysis. The interface sample has a TOC % of 3.97; the middle sample has a TOC % of 4.99; and the bottom sample has a TOC % of 5.85.

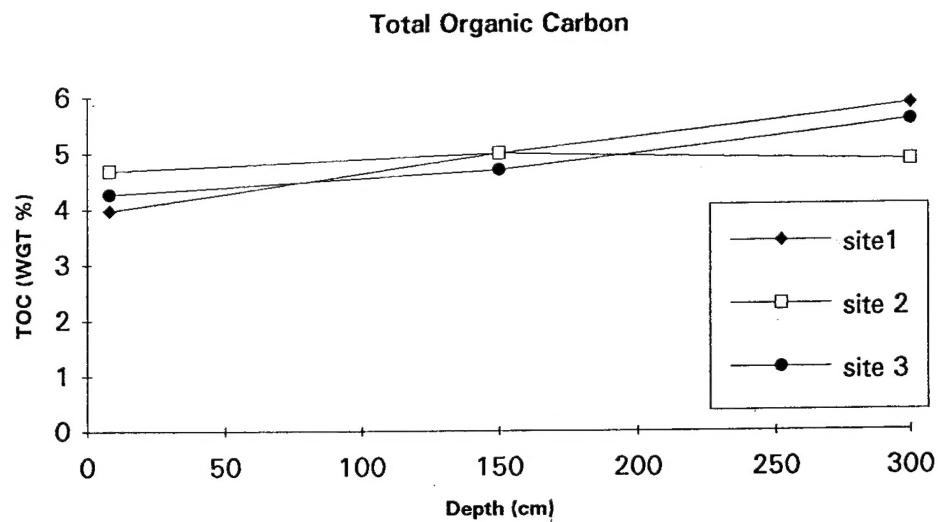


Figure 3 Total Organic Carbon for Selected Sites

Table 1 contains a synopsis of the results obtained for the processing of the first gravity core from the northern most site and as work continues we hope to be able to show the variation which can be found in closely spaced marine cores.

Depth (cm)	Water Content (%dry)	% Gas	Dry Bulk Density (g/cc)	% Saturation	Porosity %	Average Grain Density (g/cc)
9	279.38	0.46	0.31	99.47	87.12	2.41
27	281.88	0.44	0.31	99.50	87.24	2.41
44	260.32	0.08	0.33	99.91	86.15	2.39
65	246.76	0.12	0.35	99.87	85.65	2.42
82	268.37	0.47	0.32	99.46	86.58	2.39
100	263.15	1.55	0.32	98.21	86.42	2.38
118	258.47	0.70	0.33	99.19	86.14	2.39
121	211.29	1.47	0.39	98.25	83.83	2.41
134	211.14	0.80	0.39	99.05	83.78	2.42
149	188.04	3.22	0.42	96.09	82.33	2.38
168	221.42	0.40	0.38	99.53	84.33	2.42
184	211.35	2.05	0.39	97.55	83.77	2.38

corrected for 25 ppt.

Table 1 Synopsis of results from Gravity Core 1, Site 1 Eckernfoerde Bay 1994.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)			2. REPORT DATE June 1995	3. REPORT TYPE AND DATES COVERED Proceedings
4. TITLE AND SUBTITLE Geotechnical Properties of Six Closely Spaced Sites from Eckernförde Bay, Germany			5. FUNDING NUMBERS Job Order No. 74514006 Program Element No. 06D1153N Project No. 3204 Task No. 030 Accession No. DN252108	
6. AUTHOR(S) K. McCrocklin, M. Meyer, and R. Bennett				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Research Laboratory Marine Geosciences Division Stennis Space Center, MS 39529-5004			8. PERFORMING ORGANIZATION REPORT NUMBER NRL/PP/7430--96-0010	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Office of Naval Research 800 N. Quincy Street Arlington, VA 22217-5000			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES Modelling Methane-Rich Sediments of Eckernförde Bay, A Workshop held in Eckernförde, Germany 26-30 June 1995				
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) This study was conducted to observe the variability of geotechnical properties of shallow marine sediments collected in close proximity to one another. The sediment found in Eckernförde Bay was primarily soft, silty, organic clay. The site for collection was centered around a buoy located at 54°29.88N and 9°59.68E. From this reference point, six sites were chosen to form a circle and from each site 3, 3 meter cores were collected. At the northern most site, pressure cores were taken for cat-scanning and analysis in a hyperbaric chamber. We hope to be able to show the variability in marine sediments within a confined region through our collection of multiple cores from this relatively small test site.				
14. SUBJECT TERMS Marine Sediment Diagenesis, Microstructure, Clays, Physical Properties			15. NUMBER OF PAGES 6	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT SAR	